Michigan VII Update

*Designing a better transportation system through **V**ehicle **I**nfrastructure **I**ntegration*

VII and Vehicles of the Future

By Dr. David E. Cole, Chairman, Center for Automotive Research

The automotive industry is facing a technology challenge as significant as the invention of the internal combustion engine. I anticipate that what is now viewed as a crisis will go down in history as a transformation that changes mobility in the United States for years to come.

Forces outside the auto industry are driving original equipment manufacturers to take a systems perspective on automotive transportation. In-vehicle electronics provide new vehicle features (based on networked connectivity within the vehicle and with the road) that are beneficial to consumers.

Historically, the automotive industry has designed vehicles for driving on a variety of conventional roads, but without input from road builders. Similarly, federal and state road authorities and the construction industry have designed and built roads considering only the most basic vehicle design characteristics. Today, both automotive and road construction industries are starting to appreciate the benefits of a broader perspective that considers how automotive electronics can increase transportation safety and improve mobility, while offering more value to the driver and other customers of vehicular transportation.
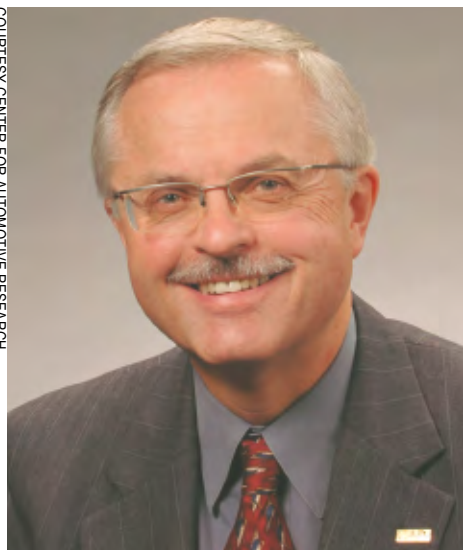
The evolution of wireless communication drives this trend. A decade ago, the mobile phone was a relatively novel tool, whereas today the cellular phone and related digital technologies are commonplace and completely integrated into the culture. Similarly, laptop computers and other consumer electronics devices are part of everyday life, and broadband wireless connectivity is expected wherever people use these devices.

The car is one of the last frontiers for consumer electronics due to the critical challenges of using electronic products in a moving vehicle. Cell phone use has become a safety hazard that distracts drivers from the critical tasks involved in driving safely. The product development and life cycles of consumer electronics are much shorter than those of the automotive industry. How can car companies assure that electronics

will work and be useful over the longer life cycle of the vehicle? Finally, reliability issues with electronics are magnified when they are installed in vehicles.

These challenges can be overcome in the vehicles of the future where safety and reliability will be essential features of automotive electronics and communication systems. These systems will support remote diagnostics and earlier detection of production problems, resulting in huge reductions in warranty costs. Broadband communications will provide manufacturers with a way to help owners maintain the vehicle regularly and to automatically update the software that will support many features of the future vehicle. Advanced communications systems will provide drivers with new safety features that will help prevent accidents, as well as improve emergency response to crashes and other incidents. Communications and electronics technologies will offer services and benefits that we haven't even thought of yet.

Michigan is well on its way to becoming the global leader in mobility innovation through VII. It is home to six automotive companies and most of the research and development that will generate the innovations for the vehicle of the future.

VII Mission:

MDOT's VII mission is to partner with public agencies, the automotive industry, and the telecommunications industry to lead the nation in VII research and sustained VII deployment by providing the public foundation for Michigan's new automotive information technology industry and ensuring improvements in transportation systems safety and operational performance.

COURTESY CENTER FOR AUTOMOTIVE RESEARCH

IVBSS Update

The Integrated Vehicle-Based Safety Systems (IVBSS) program, led by UMTRI and sponsored by the U.S. DOT, aims to prevent crashes by developing in-vehicle technologies that help drivers avoid making hazardous mistakes. IVBSS combines, as a fully-integrated suite, a set of crash-warning subsystems that address the three most common crash types: rear-end, road-departure, and lane-change/merge. These crash types account for 59 percent of all police-reported crashes and a significant amount of fatalities in the U.S. each year. IVBSS, which is being developed for both light vehicles and heavy trucks, integrates the following crash warning subsystems:

- *Lateral-drift warning* when inadvertently drifting from the lane or roadway
- *Forward-crash warning* for avoiding/mitigating rear-end crashes with other vehicles
- *Lane-change/merge warning* for avoiding possible unsafe maneuvers based on adjacent or approaching vehicles in adjacent lanes
- *Curve-speed warning* when driving too fast into a curve (light vehicles only)

The four-year project will assess the maturity, safety benefits, driver acceptance, and possible market penetration of a state-of-the-art IVBSS. The system architecture allows sharing sensor data and arbitrating multiple warnings. The driver-vehicle interface ensures that drivers can clearly and rapidly interpret alerts and warnings.

In the first year, eight deliverables were completed. Warning scenarios were defined and auditory warnings were created. Development vehicles were outfitted with subsystem hardware and software. Preliminary

development and specification of the driver-vehicle interfaces (visual, audio, and haptic information provided to the driver) on both platforms were completed. To support the development of IVBSS on both platforms, data acquisition systems that permit the collection of data from the developmental vehicles were designed.

Goals for year two include building more developmental vehicles, conducting test-track and on-road verification testing, completing human factors studies for the driver-vehicle interface, and preparing for the field operational test (FOT).

In future years, more than 100 drivers will drive a fleet of 16 sedans and 10 heavy trucks under the conditions in which they normally drive. This FOT will identify and address challenges associated with warning system integration from hardware, software, and end-user perspectives.

Project partners include Visteon Corporation, Eaton Corporation, Cognex Corporation, Honda R&D Americas, Inc., International Truck Corporation, Con-Way Freight, Battelle, and MDOT.

For more information see **www.tinyurl.com/3amkx3** or contact Jim Sayer, Ph.D., IVBSS Project Director, UMTRI, 734-764-4158, jimsayer@umich.edu.

Forward-looking camera

Rear-looking camera

Side radar

Forward radar

COURTESY EATON CORPORATION

"Big Red," the heavy-truck engineering development vehicle, uses radar and camera sensors to gather information about the roadside environment.

Data Use Analysis and Processing Update

The VII Data Use Analysis and Processing (DUAP) project continues to progress. The draft Concept of Operations (ConOps) was completed in June and is being reviewed by MDOT stakeholders. The ConOps takes its charge from the MDOT VII Strategic and Business Plan, describes the existing situation and the VII opportunity, and creates a vision for future transportation agency operations that puts the VII data to work for the agencies. System requirements are being developed in parallel with completion of the ConOps document and will be available for review in late July and August.

Currently, the DUAP project is looking at data sources from which traveler information can be created for the vehicles used in the U.S. DOT/VII Consortium Proof of Concept (POC) in and around Farmington Hills. Sources being considered include existing MDOT and Road Commission for Oakland County traffic and road maintenance vehicle data.

All of the vehicles will collect location, speed, and heading data and transmit the data through the supporting VII and private networks. Other data—such as braking status, accelerations, and weather conditions—will be provided by vehicles with those particular sensors. DUAP will receive data from those networks and convert the data to a consistent set of traffic, environmental, and asset data to be merged with other fixed and traditional data sources. Other DUAP algorithms will then calculate travel times and other traveler information that can be published to both existing outlets and to vehicles through the VII network. Together, these capabilities will demonstrate the complete loop by which:

- Vehicles traveling on the road are used as probes to collect data.
- Data is converted to information transportation agencies can use to facilitate traffic and asset management.
- Travel information and weather alerts are provided to vehicles and drivers.

The next edition of *Michigan VII Update* will cover testbeds around Chrysler headquarters in Auburn Hills. Specifically, we will look at how data collected from vehicles driven through these and other testbed locations support DUAP and the applications used to transmit and receive data for transportation agency purposes.

For more information, contact Steven J. Cook, P.E., Operations Engineer for VII, MDOT, 517-322-5709, cooksj@michigan.gov.

ITS Michigan Award

The Intelligent Transportation Society of Michigan (ITS-MI) was named Outstanding State Chapter by ITS America at the group's annual meeting in June. The chapter was honored for its work to establish a VII committee that became a core support function for MDOT. ITS-MI worked with MDOT to incorporate ITS as an integral part of road planning and engineering. In addition, the chapter has managed a nationally-acclaimed incident management committee that was the linchpin of the Regional Concept for Transportation Operations demonstration grant awarded by FHWA to the southeast Michigan region. ITS-MI has developed effective public-private partnerships, fostered sharing video images to improve transportation operations, and promoted ITS membership.

The ITS-MI annual meeting was held during National Transportation Week and attracted 300 attendees. Michigan's leadership in VII was shown with demonstrations by Continental, Econolite, Iteris, MDOT, Proxim, TechnoCom, and UMTRI.

Keynote speakers included Kirk Steudle, MDOT Director; Brent Bair, Managing Director of the Road Commission for Oakland County; Mike Schagrin from the U.S. Department of Transportation Joint Program Office; Neil Schuster from ITS America; and David Cole from the Center for Automotive Research. In addition, Peter Sweatman, UMTRI Director, was elected 2007-2008 President of ITS-MI and Kirk Steudle was elected to the ITS America board of directors.

For more information, contact Peter Sweatman, ITS-MI President and UMTRI Director, 734-936-2070, sweatman@umich.edu, or see www.itsmichigan.org.

VII Detroit Test Environment

Several organizations—including Raytheon, Battelle, Booz Allen Hamilton, Delphi, MDOT, and Road Commission of Oakland County—are involved in VII component design and testing through a VII test bed in Farmington Hills. This proof-of-concept test bed includes dedicated test vehicles traveling on about 75 miles of road. Fifty-seven roadside wireless units are installed at key intersections and use dedicated short-range communications to communicate with the test vehicles. Information exchanged includes the timing of traffic signals, advisory information for drivers, and vehicle data such as speed, direction, location, etc. UMTRI will support MDOT in evaluating methods to mine these data sources to improve traffic management and highway maintenance. The system evaluation will be completed by year-end and used to support a national deployment decision.

For more information, contact Ralph Robinson, Head of ITS Integration Center, UMTRI, 734-764-2181, ralphrob@umich.edu.

National Rural ITS Conference

The 2007 National Rural ITS Conference takes place October 7–10 in Traverse City. Attendees will share knowledge across a wide variety of ITS disciplines and learn application-specific solutions to local and multi-jurisdictional challenges. Over 30 concurrent technical sessions are offered, including:

VII Applications in Non-Urban Areas: While VII is widely applied in urban areas, the non-urban or rural applications are only now beginning to emerge. This session, moderated by MDOT staff, presents a discussion of deployment issues surrounding VII infrastructure as well as road/weather applications.

Examples of Integrating Data Across Jurisdictions: This session includes how to work with neighboring counties to share weather information, and the best ways of integrating traveler information across state lines.

1957 CELEBRATING 2007

50 Fifty Years

MACKINAC BRIDGE
Michigan

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VII: The Next 50 Years

The year 2007 marks the 50th anniversary of the Mackinac Bridge, which connects Michigan's upper and lower peninsulas. The five-mile engineering marvel was the world's longest suspension bridge between cable anchorages and provided a quicker, higher volume, year-round alternative to ferry crossings.

In 1957, transportation was focused on creating and updating physical infrastructures to connect people and places. Today, VII uses technology to create a virtual bridge among vehicles, the roadside, and drivers. VII uses real-time traffic data to make travel more safe and efficient.

Fifty years from now, VII will hopefully have had as great an impact on transportation safety as the Mackinac Bridge has had on mobility.

Data Collection for Traveler Information: This session covers the best methods for collecting data to be used in traveler information systems; how transportation agencies can achieve greater flexibility and interoperability between vendor systems; and cost-effective business models for traveler information.

For more information, contact Suzette Peplinski, P.E., Grand Region ITS Operations Engineer, MDOT, 616-451-8448, peplinskis@michigan.gov or Jim Schultz, ITS Program Manager, MDOT, 248-483-5131, SchultzJ3@michigan.gov, or see www.nritsconference.org.